

## STUDIES OF THE LIFE HISTORY OF NOMOPHILA NOCTUELLA.

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This insect, one of the common and widely distributed species of the world, is of considerable economic importance, but for some reason seems to have received but little attention from American entomologists.

In 1919 the insect became so abundant as to seriously damage several newly seeded fields of sweet clover on the Experiment Station farm at the University of Illinois. Nearly every year injury by this insect is reported from some localities in Illinois.

In 1872 A. S. Packard (Ann. Lyc. Nat. Hist., N. Y., X, pp. 258-260) gave a brief account of the insect. E. P. Felt (Can. Ent., V. 25, No. 5, pp. 129-135; 1893) gives a full description of the different stages of the insect, together with observations on its feeding habits and the number of generations occurring in New York. Judging from collections made in trap cages, he estimated that three generations of the insects occurred annually in the vicinity of Ithaca, N. Y.

So far as the writer is able to learn, no detailed observations of this insect have been carried through, even for one season. For this reason an attempt was made to ascertain the facts regarding its life history in central Illinois.

Nearly full grown larvæ were taken from the field June 6, 1919, and confined in breeding cages in an outdoor screened insectary, where conditions were practically the same as in the field. The larvæ were placed in large tower cages with plants of red and sweet clover.

The insect was carried through three generations during the remainder of 1919, adults appearing first on June 19, again July 28, and September 11. Larvæ hatching from eggs laid by the adults appearing on the latest date were from one-fourth to nearly full grown on October 30, when freezing weather prevented any more feeding for the season. Adults were noted in the field the following spring on March 21, during a period of unusually high temperatures. This period of warm

weather, however, was followed by almost a month of abnormally low temperatures, with several snow storms and many nights when the temperature was several degrees below freezing. In cages, the first adults were taken on April 21, and again on June 19, August 3 and October 4. Larvæ from the last named adults went into hibernation the latter part of October, many of them being full grown at this time.

Judging by the observations made during the seasons of 1919 and 1920, four generations of the insect occur each year, being divided as follows:

- Hibernating larvæ.
- First brood pupæ.
- First brood adults.
- First generation consisting of—
  - First brood eggs.
  - First brood larvæ.
  - Second brood pupæ.
  - Second brood adults.
- Second generation consisting of—
  - Second brood eggs.
  - Second brood larvæ.
  - Third brood pupæ.
  - Third brood adults.
- Third generation consisting of—
  - Third brood eggs.
  - Third brood larvæ.
  - Fourth brood pupæ.
  - Fourth brood adults.
- Fourth generation consisting of—
  - Fourth brood eggs.
  - Fourth brood larvæ.

The average period from adult to adult for each generation was fifty days. Females were observed to lay over 100 eggs. The average egg period was six days; average larval period thirty days; average pupal period ten days.

So far as our observations go, they pass the winter in the larval stage in heavy silken cases just at, or below, the surface of the ground, and protected by the overhanging leaves of plants, bits of which are incorporated in the cases.

Larvæ, as noted by Dr. Felt, feed mainly on legumes. The observations here recorded show that they seem to prefer red clover (*Trifolium pratense*), sweet clover (*Melilotus alba*), and alfalfa (*Medicago sativa*). They have, however, been found in a few cases feeding on blue grass (*Poa pratensis*), purslane (*Portulaca oleracea*), corn (*Zeu mays*), wild mustard (*Brassica arvensis*), cinquefoil (*Potentilla canadensis*), white

clover (*Trifolium repens*), foxtail (*Setaria glauca*), and in one instance, soybeans (*Glycine histida*). In this case the beans had been planted on clover sod, plowed up rather late in the spring, and many of the insect inhabitants of the field previously feeding on the clover had turned their attention to the soybeans.

They feed in much the same manner as Crambid larvæ, making a shallow burrow in the ground, loosely lined with silk, and a silken tube extending a short distance from this burrow. The first instar larvæ feed mainly on the under sides of the leaves, especially where such leaves come in contact with the ground. They work as skeletonizers, leaving the coarser parts of the leaves. After the third instar, the larvæ work on both the upper and under sides, and usually consume the entire leaf, unless the veins are large and very woody. Frequently the stalk of small plants, and the stems of the leaves, are cut off close to the ground, and the leaf or plant dragged to the burrow of the insect, being pulled partly within the burrow, and then nearly all consumed. The larvæ also frequently web the leaves lightly together when feeding upon them.

The insect has been observed and reported as injuring red clover, sweet clover, and alfalfa in numerous instances during the past three seasons. In several cases, crops have been seriously damaged.

A small percentage of the larvæ have been found to be parasitized.

Complete control was obtained in fields of young sweet clover by thoroughly spraying the plants with a solution of arsenate of lead, used at the rate of two pounds to fifty gallons of water.